

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of )  
 )  
The Development of Operational, )  
Technical, and Spectrum Requirements )  
for Meeting Federal, State and Local )  
Public Safety Agency Communication )  
Requirements Through the Year 2010 )

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**Comments of the  
City of Mesa, Arizona Communications Division  
161 E. Sixth Place  
Mesa, AZ 85201**

**October 18, 1996**

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## **Summary**

The City of Mesa, Arizona hereby adds its endorsement to the PSWAC recommendations. Mesa participated in the PSWAC and appreciates the work done and the substance of the report.

One significant addition Mesa offers is realignment of the core television channels to include channels 10 through 54. We feel it was a major error within PSWAC to not request additional VHF spectrum for public safety. The vast majority of public safety systems are on VHF, and they need spectrum. We suggest TV channels 7-9 (174-192 MHz) are the single most critical public safety need.

Mesa is pleased to have had an opportunity to offer comments in this proceeding. We urge the Commission to not become a party to any effort to make sure there is only competition between proprietary trunking systems. Six years of tens of thousands of hours of effort and a great deal of money have been spent by numerous manufacturers and hundreds of public employees to define an open standard. Do not let politics enter into this process when customer acceptance is what should drive it.

## **I. Introduction**

The City of Mesa is Arizona's third most populous city with approximately 340,000 residents. Mesa is about 123 square miles in area and is a part of the greater Mesa-Phoenix metropolitan area which includes about 2.5 million people. Mesa supports a broad array of service departments including police, fire, utilities (water, electric, and natural gas), sanitation (both residential and commercial), waste water, city parks, and two airports. Mesa City government includes over 3,000 employees including over 1,000 in its police department and 341 people in its fire department which staff 15 fire stations. Mesa operates a public safety 9-1-1 and dispatch center which dispatches police and fire services for Mesa and fire and EMS for the Town of Gilbert and the Apache Junction Fire District. Mesa's conventional radio systems average over 1 million radio transmissions per month.

## **II. Background**

For many years, Mesa led the nation's cities in growth. Mesa has historically doubled its population every decade from 1940 to 1990. This growth has slowed, but in the past six years, Mesa's population has still grown by 56,000 people or 19%. At the same time, Mesa's incorporated area has grown in area from 2.33 square miles in 1940 to 122.97 square miles in 1996. Mesa's total budget appropriation was \$395,218,000 for its fiscal year 1996/97. Mesa's law enforcement program for 1996/97 has a budget of over \$75 million and its fire prevention program is almost \$27 million.

In 1983, Mesa was feeling the severe pinch of the need to modernize its radio communications capabilities. From that time until 1988, Mesa greatly expanded its communications use. It added police and fire radio channels and installed its second

generation of mobile data (MDT) and its second generation of Computer Aided Dispatch (CAD). By 1995, these systems were severely overloaded and planning has been completed for replacing radio, MDT, and CAD systems. In addition planning has been completed to add Automatic Vehicle Location (AVL) in 325 vehicles. A trunked radio system, multi jurisdiction CAD, MCT, and AVL are budgeted, and in the process of procurement. In aggregate, this amounts to \$25.4 million.

An adequate number of frequencies are not available for Mesa to license to move all of its radio systems to a new 800 MHz trunking system. Actual traffic loading taken from two years of data collected from all of Mesa's radio systems, indicates that seventeen working channels are needed to support the more than 3,000 radios Mesa will need. there are ten channels total available for Mesa. This means that Mesa will not be able to move all of its operations to the most efficient and effective system possible. Mesa will be forced to retain many of the VHF and UHF frequencies it presently uses.

Mesa is partnering with the City of Phoenix to build compatible but independent systems tied together in a larger network. The architecture we have chosen is Project 25. Initially, we expect to tie three Project 25 RF subsystems together to form the core of the network. This network will allow cooperative use of independent (but compatible) systems for full metropolitan area (1,000 square miles) roaming and for valley wide interoperability within fire and EMS uses.

### **III. Discussion of WT Docket 96-86**

#### **A. Definition of Public Safety and Interoperability**

We concur with the Commission's proposal to adopt the public safety definition's

that came out of the PSWAC. The ultimate test of whether a service is public safety should be its governmental status. For all of the reasons in the PSWAC Interoperability Subcommittee report, government at all levels needs access to protected spectrum to serve the public.

## **B. Interoperability Issues**

We disagree that agencies currently most likely use technologies that are incompatible with the equipment used by other agencies. Proprietary trunking systems are not the most prevalent type of system. The biggest problem in interoperability is the lack of spectrum designated for nationwide interoperability. Links between disparate technologies are not the answer to interoperability; spectrum is the answer. The use of links between systems is spectrally inefficient. They do nothing for ubiquitous subscriber (field) equipment use if coverage patterns of disparate technology systems are not congruent. Links are an answer wherever proprietary technology is used only if the coverage patterns of systems is the same.

We do agree that the need for contiguous frequencies should be the Commission's primary focus in dealing with the present's almost total lack of interoperability. Secondly, when such spectrum is allocated for interoperability, a baseline technology must be required. This baseline technology should be at least as spectrally efficient as FCC rules require within the greater band, and they should be open standards. Initially, our suggestion is FM in a channel bandwidth consistent with the band channelization that is used. We believe there will be a slow inexorable transition from analog to digital modulation within public safety, and at some future date, a digital baseline technology

should be required for interoperability.

### **C. Definition of Public Safety**

We endorse adoption of the PSWAC definition of public safety. We believe these definitions are intentionally sufficiently broad for all of the functions of public safety agencies. The litmus test for inclusion in public safety should be whether it is a function of government. In the event that a government entity contracts for a service (such as fire or ambulance service) the responsible government agency should be the licensed party. Since government would hold all public safety authorizations, changes in the contract holder would be a simple matter of transfer of the authority to operate on government's behalf.

Public Service groups (under the PSWAC Public Service definition) should have access to interoperability channels. Public Safety and Public Service have many needs to be able to interoperate.

### **D. Interoperability Definition**

We agree with the PSWAC definition of Interoperability. Although PSWAC dealt with both infrastructure dependant and independent links, the lowest common denominator must be independent of infrastructure with a base line mode of operation. The ability to interoperate must have a graceful decline in capabilities as elements fail. At the very most critical level, field units must be able to communicate with each other without the aid of any translation or gateway devices.

Public safety uses day-to-day, mutual aid, and task force types of interoperability in that declining order. Alternatively, the risks to personnel and to the public are generally in an increasing order. The Commission must realize that the majority of users and the

maximum exposure to emergencies is not in the high density metropolitan areas. a nationwide interoperability capability cannot be built upon gateways between different geographical coverage systems using disparate technologies. Spectrum must be allocated nationwide so that communications abilities for disasters and emergencies have a common set of solutions across the entire country. We support PSWAC's recommendation for 2.5 MHz of unbroken spectrum contiguous to either the VHF or UHF Land Mobile allocations. Mesa believes the most appropriate and most effective spectrum is a portion of TV channel 7 (174-180 MHz). This spectrum would be usable in existing equipment. A single interoperability band could also make possible dual band equipment of commercial quality.

An allocation below 100 MHz (low band) should not be considered as an option. Commercial equipment is not available, noise and skip are big deterrents, and antenna considerations are huge drawbacks. At the same time, an allocation above 500 MHz is not a viable option for a sole nationwide interoperability band. Eight hundred MHz systems are a metropolitan solution. As much as the Commission would like to see everyone on 800 MHz trunking systems, to the vast majority of users throughout the nation, high density 800 MHz systems are economically and technically not feasible. A nationwide interoperability band needs to be between 100 and 500 MHz. Mesa believes that the ideal allocation would be either in the 138-144 MHz or 174-180 MHz band.

Irrespective of where the Commission can site a new Interoperability band, Mesa endorses the PSWAC recommendations to also establish a sufficient quantity of designated interoperability channels within the 150-174 MHz and 408-420 or 450-470

MHz bands. The reason for this is that to be effective within a reasonable amount of time, these frequencies must be usable in existing equipment. For at least the past ten years, radios have been programmable and have had a bandspread capable of transmit and receive operation across the entire band. there must be allocations made which will quickly give some emergency capability, and it must be through finding a way to put it into existing equipment. The transition to a final solution of nationwide interoperability will take much longer. Mesa has equally about 1500 VHF and 1500 UHF radios which could immediately be programmed for designated frequencies in either or both bands. We estimate Mesa's cost at adding separate radios for a longer term interoperable band at \$400,000. We believe dual mode equipment to include a future interoperable band would probably increase our costs to \$900,000. The reason for the wide difference is that we would equip 500 radios now versus 3,000 radios on a long term basis.

Commercial systems are already used by Mesa. We lease 769 pagers and service for 218 cellular telephones. Although we lease a large number of pagers, we also maintain 105 pagers on a system we own. These 105 pagers are with people that we absolutely must reach in emergencies. We cannot afford a 42 minute queue time we once had on the commercial system. We also have cellular telephones for EMS use in 19 fire vehicles. these are used by paramedics to talk with Mesa's four hospitals. We also have UHF portable radios for the same function as a backup. We cannot rely upon a cellular phone system during emergencies because of cell blockage. During an emergency, the patient does not care that the FCC felt it expedient for us to use commercial services. Our job is to make sure we can communicate during all emergencies. We already use commercial

services wherever we can. The Commission must rely upon us to make the decisions of where such use is appropriate.

Mutual aid channels should be designated for public safety use. They should not generally be subdivided by service. A future planning effort should be undertaken to decide upon the nationwide guidelines for use. We have seen fire emergencies where the one Fire mutual aid channel we have has been brought to its knees while the police interagency channel was unused. We have also seen the reverse. The conditions of the emergency should dictate channel use; the rules should not dictate use. We do agree with the Commission's four priorities for mutual aid channel use. (NPRM IV, A, 40)

Mesa favors that the FCC requires equipment for public safety use should be capable of including a common communications mode and frequency band. We do not favor that it be mandatory for the manufacturer to include it. We feel it should be at the user's option to purchase such capability. Mesa would include it in almost 1,0000 radios if dual band was required. If we could get a mutual aid allocation into equipment without dual banding, and without requiring use of a second radio, we would equip over 3,000 radios. In the first case we would equip those first responder types of radios where the cost could be justified; in the second case, we would equip all radios.

We support the Commission requiring all radios which are type accepted or sold for use on public safety frequencies to be capable of operating on the designated mutual aid channels. The effective date we suggest should be five years after adoption of new rules. Multi-band radios are only feasible if there is a single, nationwide mutual aid band. We do not believe it is practical or economical unless one of the two bands is a constant.

Again, we believe it should ultimately be the users decision to purchase that option, but we believe the capability should be there.

### **Operational Issues**

Mesa believes that there should be three very distinct types of systems. First, there are the vast majority which need the propagation and low cost attributes associated with VHF conventional systems. These are by far the most numerous. Second, there should be the medium density metropolitan systems. The smaller of these could use conventional UHF systems and the larger should use UHF (450-470 MHz) or 800 MHz trunking. The third case is one we believe will occur sometime in the future. This is a very high density, metropolitan area use.

The vast majority of systems now in place are small ones. They are a base station and a small number of mobiles. They are spread across the country like the pixels that make up a CRT display. There is no way that they can support a complex and expensive infrastructure. What they need is enough clear frequencies to carry out their business and separate mutual aid frequencies that are immediately available to them. VHF propagation and the cost of VHF equipment are what they need. The second users of these systems are wide area. These are systems which need to move resources across large distances and be able to use their communications systems everywhere. VHF systems offer the best solution both in propagation and in the acceptable distance for reuse. Even whole states do implement economical statewide VHF systems.

We believe VHF systems are inappropriate in metropolitan areas. Building penetration is not as good at VHF as it is at 450 MHz, and it is even better at 800 MHz.

At the same time VHF use in the cities precludes reuse of the channels for too large a distance. We see cases in Arizona where VHF systems used on mountains around Phoenix preclude use throughout 50% of the state. At the same time, these Phoenix systems would get the building penetration they need much better by using 450 MHz or 800 MHz systems. Propagation should be a tool matched to a need; it should not simply be a by-product of the frequency that was licensable.

Metropolitan area systems in Arizona are moving towards 800 MHz trunking systems. The density of our use dictates trunking even in the face of much greater cost. Mesa's VHF and UHF conventional systems cost about \$3 million in 1986. We are estimating those systems replacement cost at over \$16 million.

The third type of system we believe must evolve is for very dense applications. We believe these systems will probably use TDMA, and they will be very infrastructure intensive. Where their use will be needed is where the concentration of users is so intense that there simply is no possibility of additional frequencies. Bandwidth - not frequencies will be the determinant. The second attribute we believe these systems will have will be that their need for mutual aid and interoperability will be small. These systems will be so big, that their communications needs will all be internal. In these cases, complex, infrastructure intensive systems may make some sense. We believe only the very largest cities will eventually need this solution.

Public safety relies heavily upon microwave systems, and the need for more microwave spectrum will grow also. In Mesa, we have over half of a thirty-one hop system now in place. this is an all digital network. Its purpose is for reliable and secure

radio communications system control, data system support, emergency telephone system, and utility system supervisory control and data acquisition. Spectrum at 11 GHz and below is extremely difficult to license in the Mesa area. We are forced to place the major portions of our microwave system above 17 GHz. Although not usually associated with the concept of rain problems, Mesa indeed must confront them. Rain rates here often do disable portions of our system. This past August we had eighteen outages for up to 28 minutes. During that 28 minutes we lost the ability to dispatch fire and EMS units in a neighboring jurisdiction. Meanwhile, the strong summer monsoon rain was running off so heavily that we had areas of flash floods. Lack of frequencies not susceptible to rain fades forces us to put more microwave systems in in order to get alternate routing to critical sites.

Mesa has a need for enough spectrum to feed real time, full motion video. Our suggestion is the spectrum 1710-1755 MHz in the PSWAC report. We have two full time helicopters where we have contemplated use of amateur radio operators to get video feeds from the helicopters. Although feasible, the amateur route might be usable for parades and community service applications but not for police applications such as surveillance and traffic control. In addition to Mesa's helicopters, Maricopa County has four, Phoenix has eight, and the State Department of Public Safety has two in this area. If suitable spectrum is available, almost all of them can be made much more efficient and effective by the addition of air-to-ground video.

Mesa will be installing its third generation of mobile data devices within the next four to sixteen months. The over-the-air data rate is going from the present 4800 bps to

19.2 kb/s. The bandwidth will remain the same at 20 kHz on 25 kHz spaced channels. This use is consistent with the data portion of the Commission's refarming rules. The present system is being expanded from 200 vehicles to 325 vehicles. System overloading has limited the present system to 200 vehicles. The data system itself is capable of supporting additional agencies, but we do not have UHF frequencies available to support more users.

We are also adding AVL to these 325 vehicles. In order to support the AVL, we had to take away an 800 MHz NPSPAC frequency from our future voice system. Calculations say we need seventeen channels and we have nine. We might as well be short eight instead of seven. This means we cannot use the most efficient 800 MHz trunking system we are building for all Mesa units. We must keep much of the conventional system we already have as well because there are not enough 800 MHz frequencies available for us to do it in the most efficient manner.

### **System Requirements**

In the Mesa-Phoenix metropolitan area, the fire services are moving towards consolidated systems. Fire and EMS is much more reliant upon day-to-day mutual aid than police is. In fact, in our area, the valley fire agencies are moving towards automatic aid. Automatic aid is where the closest available unit is dispatched - regardless of jurisdiction. To the public, this certainly is the most efficient and effective use of the service. The successful use of aid requires a much greater ability to communicate with each other.

Mesa has dispatch agreements with two other jurisdictions and several more would like to join. Phoenix dispatches fire and EMS for itself and eleven other jurisdictions. We know that the most effective system for us both is trunking, but Mesa is short eight

frequencies and Phoenix is short more than that. Because we do not have enough 800 MHz frequencies to build an efficient system, we will need to be much less efficient and keep conventional systems. Meanwhile, the jurisdictions outside the Mesa-Phoenix area will not get the relief they should have received from Mesa and Phoenix getting off of VHF and 450 MHz frequencies. In our case, we need additional spectrum adjacent to the 800 MHz band so we can build the efficient shared systems the Commission wants us to build. One way to achieve this relief would be to follow the PSWAC recommendation and allocate part of TV channels 60-69 to public safety. The effect in Arizona would be felt throughout the state in all frequency bands as users could migrate to the best systems for their own use. The wide area and rural people could get relief as the metropolitan areas vacated lower frequency systems as they moved to 800 MHz.

The most effective use of a Mesa trunking system is to put all of Mesa's users onto the system. We have about 1,000 radios which are in use mostly during the normal work week. Few of these units are active in the evenings and weekends. These quiet times for general government users are precisely the peak times of police and fire activity. By putting both types of users onto the system, there is a load-leveling effect. The system must be sized somewhat higher, however, because during storms and emergencies all units are active and the per-unit traffic goes up as well.

System sharing is a community decision. Mesa is sharing use of its conventional system now and will share use of its trunking system. Sharing cannot be mandated. Sharing is an outgrowth of local conditions and local decisions. The Commission's responsibility is to make enough spectrum available so that the efficiencies of shared use

are possible. In our case, we have actively participated for four years in Project 25 because of our belief in the architecture and competitive goals of that process.

Project 25 brings to us the ability for Mesa to make a decision for itself and for Phoenix to make a decision for itself while being assured that there will be network compatibility in the end. Neither Phoenix or Mesa would agree to be in a system owned by someone else but both of us agree that we want compatibility. Project 25 brings that to both us while still getting competition for each of us in the procurement. The end result will be a system that supports both of our valley wide needs without either of us overbuilding the other. Project 25 is the only way we see that we can reach the Commission's goals of increased use of shared systems without the burden of any jurisdiction being subservient to another.

The Commission should clearly understand the limiting effects of fostering and maintaining proprietary technologies. One manufacturer may claim erosion of competition, but the reality is a plea to maintain competition of two proprietary technologies versus open competition of multiple manufacturers building to a standard.

Mesa expects that others will add their own compatible nodes to the Mesa-Phoenix network in the future. When they are ready to do that, their addition will not duplicate the network; rather their system will enlarge the network. They will add coverage for Mesa and Phoenix and they will get coverage from Mesa and Phoenix. Because of the open protocol, neither Mesa nor Phoenix will dictate their choice of supplier. The only limit to how many users we can accommodate will be the availability of 800 MHz frequencies.

System administration is a non problem in the Project 25 architecture. Each agency

will be able to maintain its own fleet records within each node. In different nodes, system use is an individual choice. Different requirements can be implemented in the node while still allowing roaming and interoperability within the network.

### **Technology Issues**

Our understanding is that what was 6 slot, 25 kHz TDMA has been reduced to 3 slots in order to get the voice quality up to acceptable standards. The TETRA standard is four slots in a 25 kHz channel spacing. Mesa believes that both TDMA and CDMA are risky options for public safety. Risky in the sense that because they are complex infrastructure mandatory solutions graceful degradation through successive failures under emergency conditions could obviate their use in public safety. Risky also in the sense that there must be some basic unit-to-unit communications capability without the need for any infrastructure.

There conceivably could be some very dense systems which require very high levels of capacity which could use these technologies. We believe even those highly dense system users would not want to use these types of system. The choice to them might be in feeling the infrastructure was extremely reliable and the trade off was in getting the capacity they needed or not. Under the condition that it was the only option, they might have to agree. We do not know of any public safety user who would volunteer to provision such a totally infrastructure dependent system, however.

In IV.C.64 you ask about phased antenna use to increase system capacity. This type of system works in cellular applications where the communications is basically a one person to one person link. At the cell end, it certainly makes sense to only illuminate the

sector where the person is. Most public safety communications, however, are a one person to many (broadcast) link. A police patrol district most often requires everyone in the district to hear every transmission. Within public safety, directed antenna patterns are important in containing signal to the operational area.

We believe it would be helpful for the Commission to give some form of licensing incentives for the use of trunking. Public Safety does and will continue to use trunking where it makes sense, and it is economical to do so. It is another infrastructure type of system which must require the capacity increases it brings relative to its cost. Simply because it is a more effective use of the spectrum will not mean that it is the system most public safety users can use. The vast majority of users are the dots on the map with a base station and mobiles. The commission must keep this globally in mind. Infrastructure dependent systems are solutions only where the density requirements exist.

#### **D. Spectrum Allocations**

Mesa agrees with the PSWAC frequency allocation recommendations except we believe they left out one of the five critical elements we thought they should identify. We feel there are five critical needs

1. Additional VHF spectrum for rural, wide area, and small users.
2. Additional spectrum contiguous to the 800 MHz band.
3. Additional sharing with TV between 470-582 MHz.
4. Additional microwave spectrum for point-to-point applications.
5. Wide band data and video spectrum.

PSWAC did not adequately deal with issue No. 1, the need for VHF Spectrum.

We believe the Commission should adjust its core television channels upward to include channels 10 through 54. We strongly recommend that the band between 174-192 MHz should be reallocated to public safety.

Mesa also strongly recommends 24 MHz of spectrum from television channels 60-69 should be reallocated for public safety use. These uses would include additional voice spectrum and new evolving technologies. We suggest channels 60-61 (746-758 MHz and 68-69 (794-806 MHz) for public safety use.

Mesa supports the PSWAC recommendation to share the 1710-1755 MHz band with federal users. This spectrum would be highly usable for video applications such as Mesa's need for full motion air-to-ground video. It would also support large file transfer data applications such as those needed for geographic information system uses in police and fire vehicles.

Mesa also supports the PSWAC's recommendation that public safety should be allocated the 4635-4685 MHz band. This band could offset some loss of the 2 GHz PCS spectrum for long distance terrestrial microwave, perhaps video, and wideband data.

The real issue is the Commission must allocate spectrum that is usable. There are two distinct types of public safety land mobile systems: wide area/rural and urban/metropolitan. Previous 800 MHz allocations were really only usable in the urban environments. That is why fifteen years after the allocations there are so few statewide 800 MHz systems. The cost of building such systems is many times the cost of building comparable VHF systems. We strongly urge the Commission to recognize the needs of both types of users. Public safety needs more usable VHF spectrum and we need more

450 and 800 MHz spectrum.

Mesa does not believe that the Commission's unwillingness to deal forthrightly with the problems of public safety should pit the nations public safety users against our country's defense agencies. We take DoD at its word within PSWAC that they would look at sharing of the 138-144 MHz band and that sharing is unacceptable between 380-400 MHz. We believe a much greater sharing with broadcast is possible between 470-512 MHz, and we urge the Commission to write the necessary rules to allow it. Mesa believes that if significant allocations are made from TV Broadcast from 174-192 MHz (CH 7-9) and 746-806 (CH 60-69) and if increased sharing of 470-512 MHz (CH 14-21) occurs, we will be able to deal with the public safety problems.

Respectfully submitted,

A handwritten signature in cursive script, reading "Donald W. Pfohl".

Donald W. Pfohl  
Communications Director

DP/sr  
comments.wpd